.r Conditioning for Railway Passenger Cars

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Synopsis—*Among the many efforts to increase the comfort of railway passengers, air conditioning of ssenger cars is one of the most recent and technically most interesting improvements inaugurated by the ltimore and Ohio Railroad.*

Attention should be called to the fact that the art of air conditioning as applied to railway cars is w and while it is believed that it is founded upon sound principles, considerable development is necessary perfect it for general railway application. In the first place, power supply while the train is in transit has ɔt been developed to a sufficient extent to warrant at this time the general application of air conditioning quipment to railway cars. Space and weight limitations of the air conditioning equipment must be reduced nd its cost must be brought down. The system must be simplified to insure integrity of operation and reasonable cost of maintenance. Further developments are necessary to improve the atmospheric condition in cars during the winter when very often the air becomes excessively dry and in order to avoid this moisture should be added to the air, i. e., it should be humidified, while in the summer it is necessary to dehumidify t. Further experimentation is now being conducted along these lines.

This paper is the first which has been presented before a technical society on the subject of air conditioning for railway passenger cars and is, therefore, the beginning of the technical literature on the subject. Brief articles and references have appeared in the daily press and in certain magazines dealing more particularly with the popular phases of air conditioning as applied to railway cars and especially enhancing the attractiveness of railway service due to the elimination of all dust, dirt and cinders and the control of temperature and humidity, particularly duri 1 the summer season.

VENTILATION of the interio of railway passenger cars to prevent unfavorable atmospheric conditions has for many years been given much attention by railroad managements and equip- designers, but a complete and satisfactory n of the problem from the standpoint of free- air from dust, soot, cinders and other foreign r and conditioning it with respect to tempera- and humidity was not obtained until July, 1929. generally recognized that a practical solution e problem of conditioning the air for railway nger cars, especially during the summer, is de- e but a satisfactory solution of the problem een retarded, if not prevented, because of an quate supply of electric energy available on the g train, as well as space and weight limitations required equipment applicable to individual cent advances in the art of electric power on on the moving train and development in nditioning equipment offer promise of over- these limitations.

Power Supply

As power supply in sufficient quantity and reliability is the most important factor in the solution of the problem a brief reference to the early history and the present state of the art of power generation on the moving train will be of interest. Prior to the development of the axle generator, a little more than twenty-five years ago, steam generating units were installed in some baggage cars for the purpose of supplying electric energy for the operation of lights and fans in the several cars of the train. The steam was supplied through a hose connection from the locomotive. Later on a few gasoline engine driven generating sets installed in baggage cars were used for this purpose. Still later steam turbine driven units of about 20 kilowatts capacity and operating at 60 to 100 volts direct current were used with considerable success, especially on railroads operating west of Chicago where conditions were favorable to a lighting and power system of this character due to the fact that the trains were not broken up to any appreciable extent while in transit

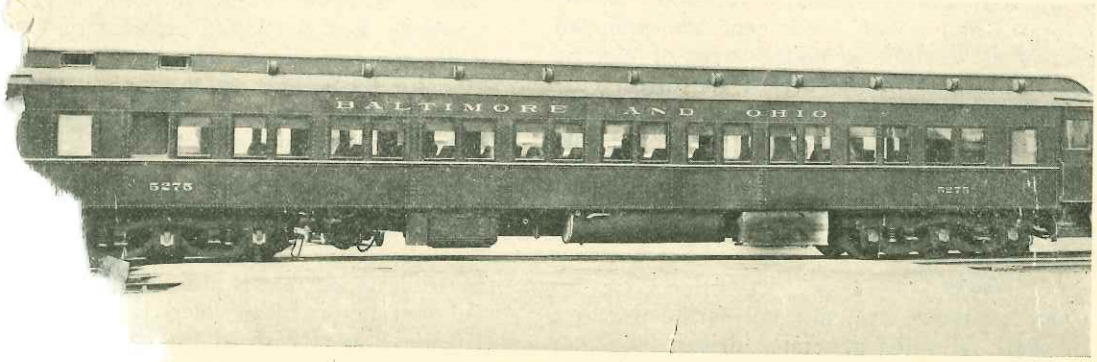

Fig. 1
Car in the World Equipped for Complete Air Conditioning—July, 1929

d where the cars are regularly assigned for this vice. In eastern territory, where the make-up of ins is frequently changed by the addition or oping of cars and where foreign cars enter the up of the train, also where the cars are not arly assigned to the service, it was found that ead end system of power supply was not well apted to the requirements and imposed restrictions upon the use of the equipment.

This form of lighting, however, has been and is still operating very satisfactorily on a great many suburban trains, both in the east and west, where the cars are regularly assigned and foreign cars not properly equipped do not enter the make-up of the train. There are approximately 30,000 elec-

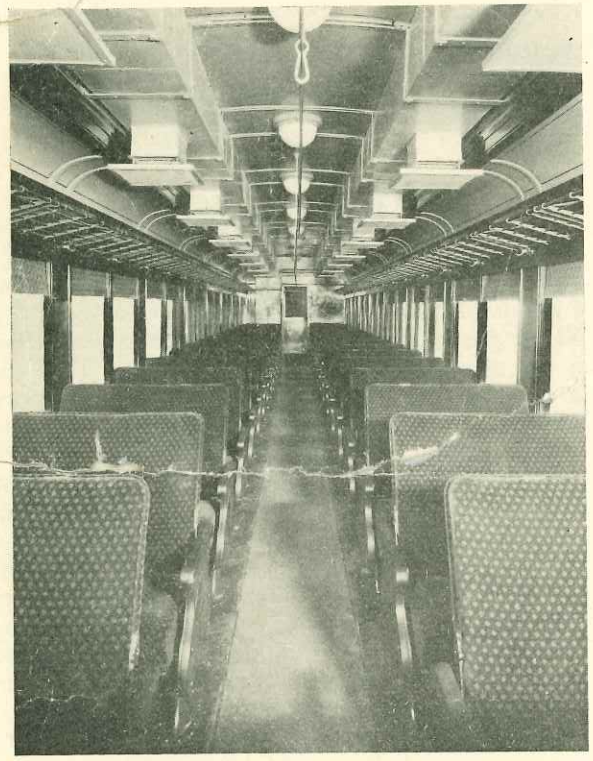

Fig. 2
COACH 5275—SHOWING AIR DISTRIBUTION DUCTS

trically lighted cars on Class 1 railroads in the United States and about 3 per cent are equipped for the use of straight storage system of electric lighting, 3 per cent for the use of the direct current head end system and the remainder the axle generator system. About 40 per cent of the passenger equipment cars on the Class 1 railroads are lighted by oil or gas, 54 per cent by electricity and 6 per cent are not equipped with any lighting system.

Axle Generator System

The axle generator system involves the use of a body or truck mounted generator driven by pulley and belt or positive drive from the car axle, the necessary automatic regulators, switches, etc., and a battery on each car. Direct ... is supplied but there are a few cars ope... 64 volts. Each car may be equipped with a... head train line so that it may be electrical... nected to an adjoining car where the same ... of lighting is used. Receptacles are provi... battery charging from an external source. ... a few business cars equipped with the ax... erator system are also equipped with trans... and a receptacle whereby alternating curren... an outside source may be furnished where ... is parked for a considerable period of time. ... this system the car is the unit and if properly ... tained the lighting equipment is available for s... at all times on home and foreign lines and the ... can be placed at any position in the train.

Axle generators are in general use up to a ... imum of 4 kilowatts capacity, although a few ... watts capacity machines have been supplied. Under adverse weather conditions, such as snow and ice, the availa... capacity is greatly reduced because of excessive ... lt slippage. Other forms of drive to overcom... his difficulty have been tried out but until recently ... thout commercial success. Certain forms of positive drives have recently been applied to a limited extent on some of the Canadian roads t... overcome excessive belt slippage due to snow an... ice. Also the Baltimore and Ohio installed in ... this year a gear type of drive for a specia... capacity (10 kilowatt) generator which is n... service supplying electric energy for operati... air conditioning equipment installed on dinin... Martha Washington, a complete description which is given later on in this paper. Other ... roads are also now experimenting with po... drives for generators of from 3 to 7½ kil... capacity.

Central Energy System

All power supply systems of the axle gene... type, however, are of an intermittent charact... output of the generator being available onl... the car speed is above, say, 16 to 25 miles p... As a consequence sufficient battery capacity m... provided on each car to take care of the li... and power requirements when car is stan... stations or operating at speed below the ... point. In order to provide for an ad... pendable and continuous source of po... while the train is in transit, thus ove... capacity limitations of the present gen... axle generator devices which provide ... tent power supply, some form of cen... tem modeled after that of the ... pears to be desirable in order ... increasing electrical require... equipment cars. At the same ... be so designed that it will n... ful operation, with minor ... trically lighted cars of the ... storage or head end syste... now be equipped. In addi...